FIG. 1

H0990439

See drawings filed 8/25/00

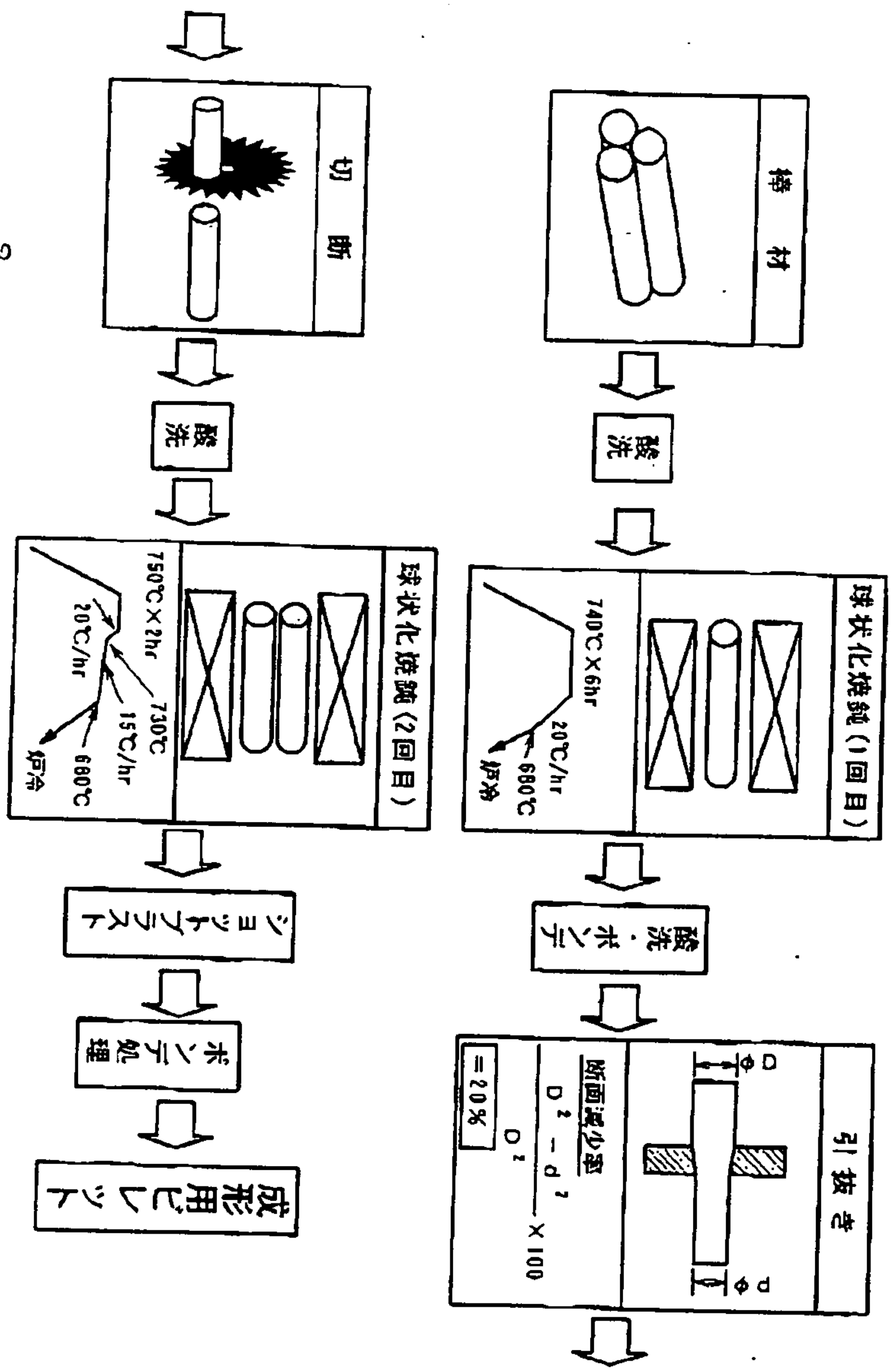


FIG. 2

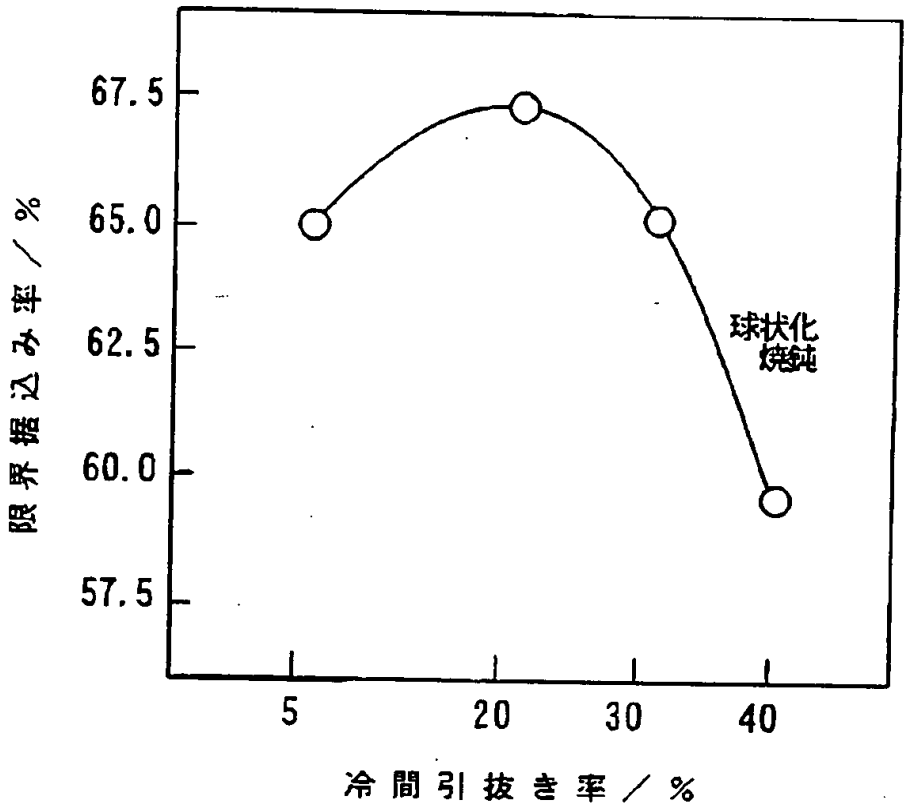
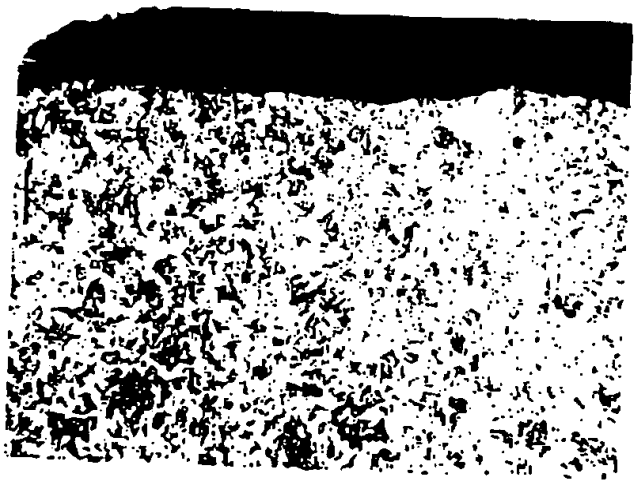
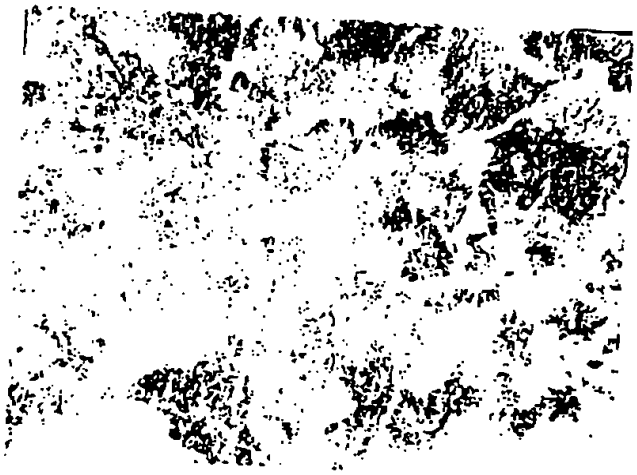


FIG. 3



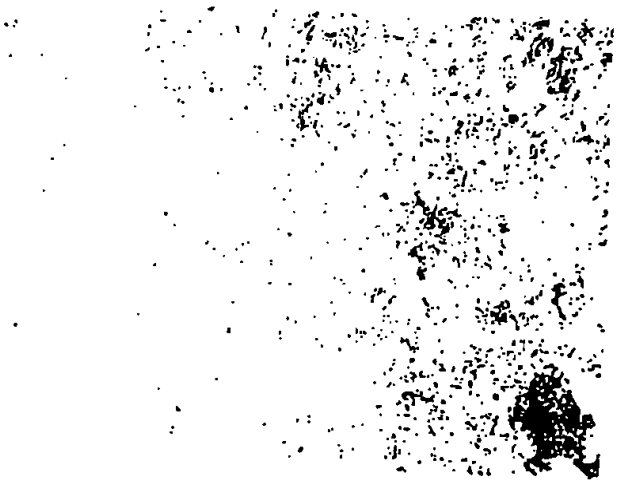
(a)



(b)

FIG. 4

(a)



(b)

FIG. 5

(a)

(b)

FIG. 6

(A)材料1

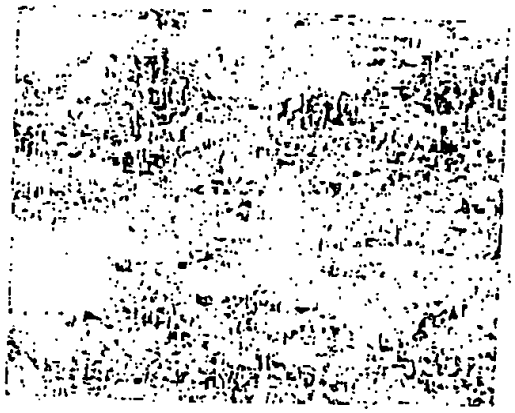
アスペクト比＝５０６％

(B)材料2

アスペクト比＝３４７％

(C)材料3

アスペクト比＝３００％



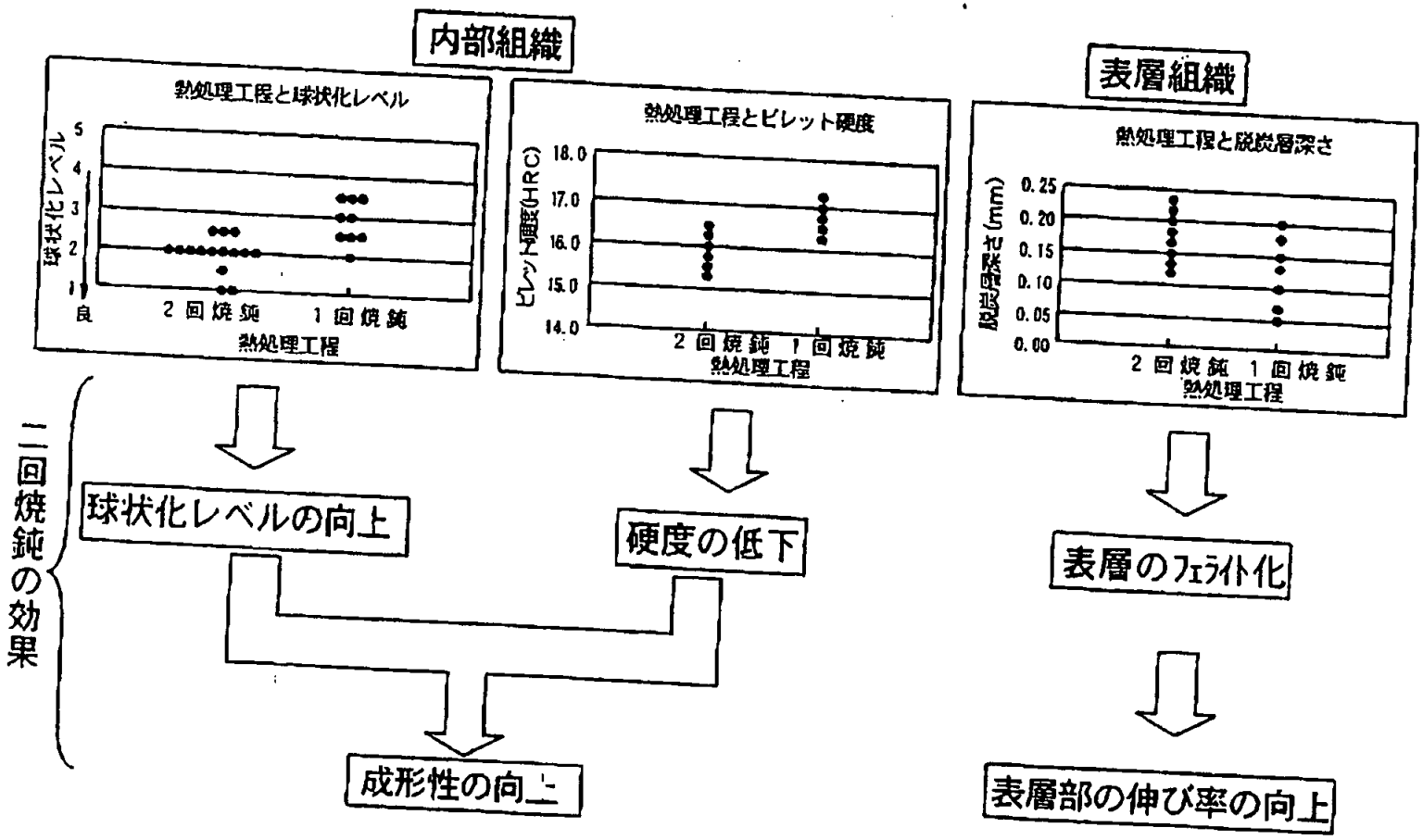


FIG. 7

FIG. 8

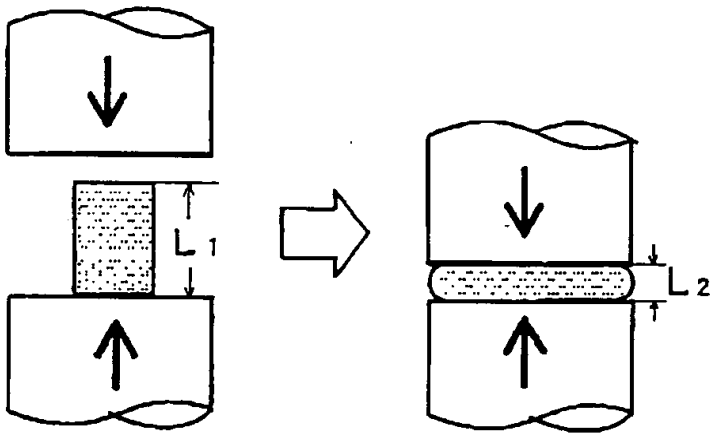


FIG. 9

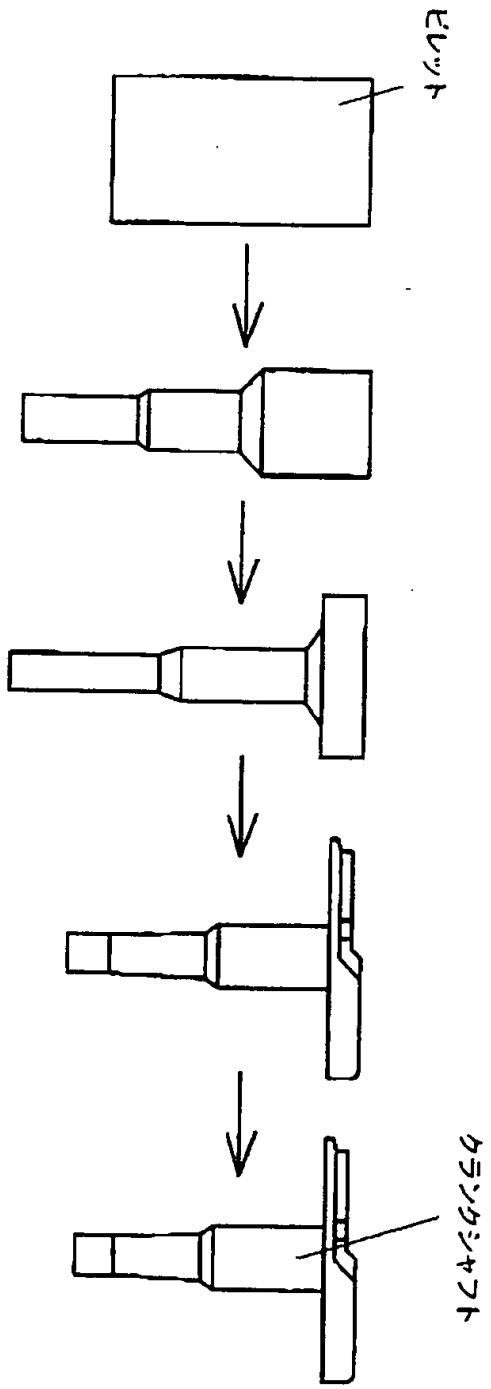


FIG. 10

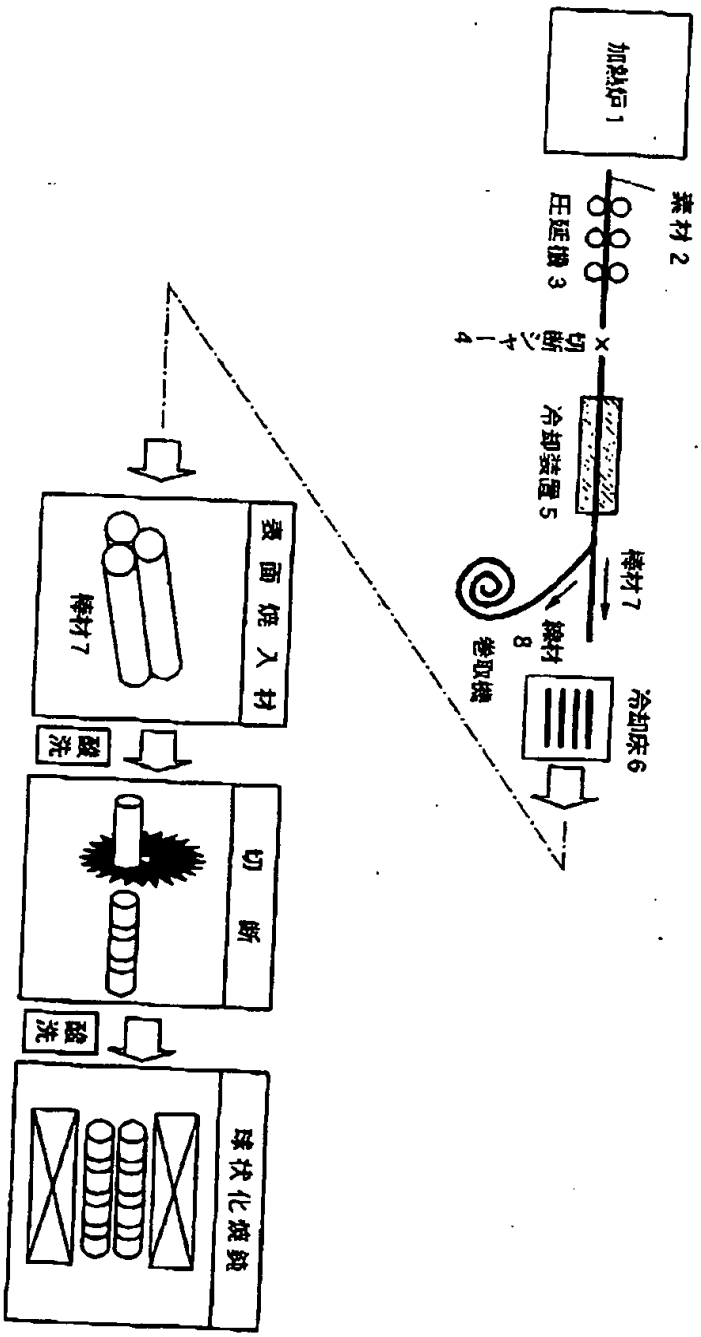
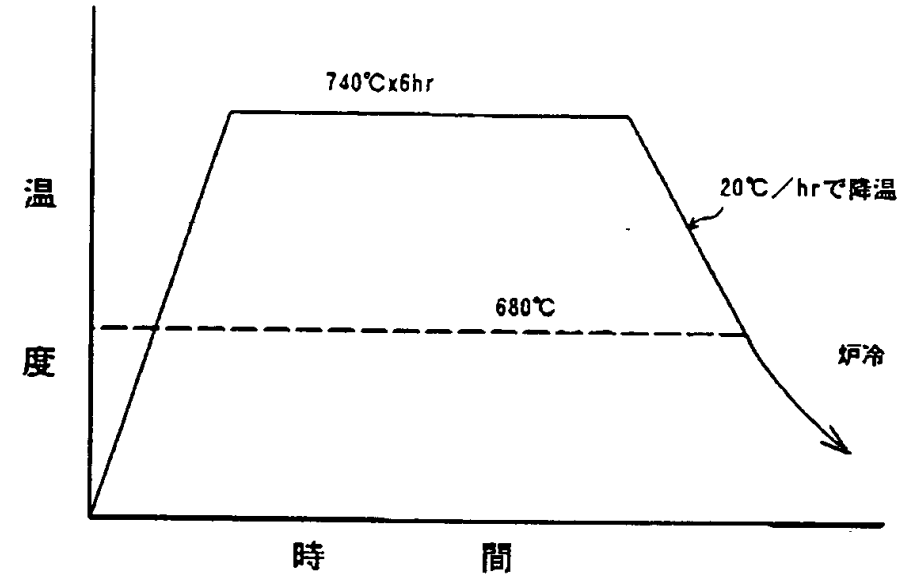
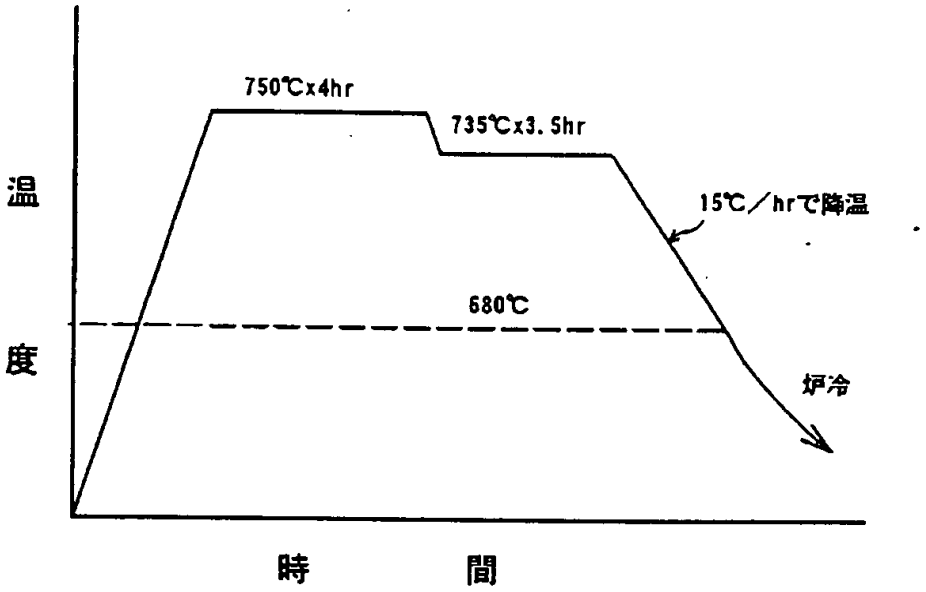

加熱炉 1
素材 2
圧延機 3
切断シャー 4
冷却装置 5
冷却床 6
棒材 7
棒材 8
巻取機
表面傷入材
棒材 7
酸洗
切断
酸洗
球状化焼鈍

FIG. 11

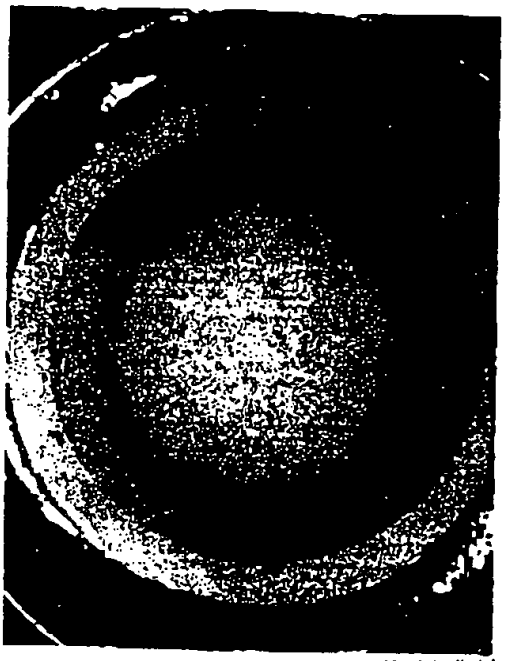

740℃x6hr
温
20℃／hrで降温
680℃
度
炉冷
時
間

(a)


750℃x4hr
735℃x3.5hr
温
15℃／hrで降温
680℃
度
炉冷
時
間

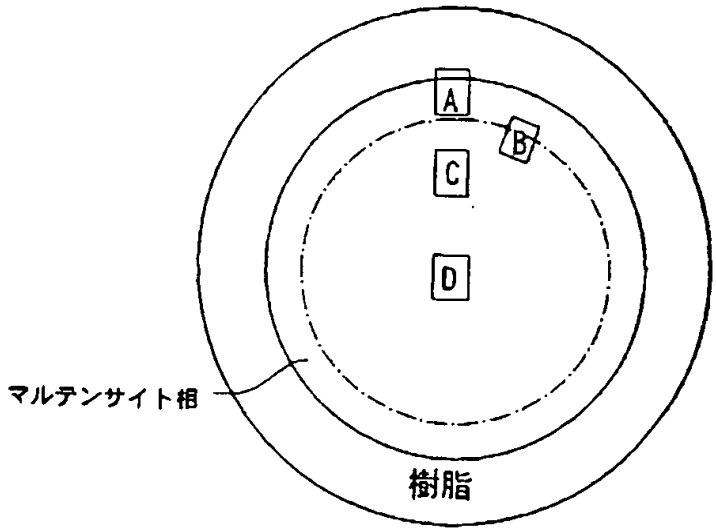
(b)

FIG. 12



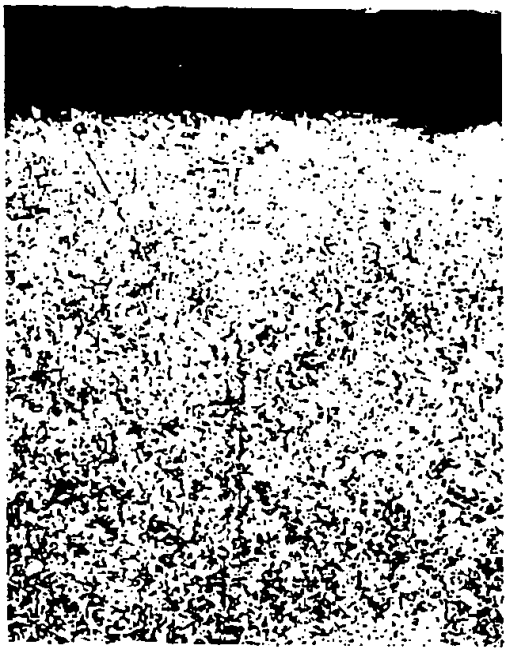
マルテンサイト化材
球状化焼鈍前
×２．１

(a)



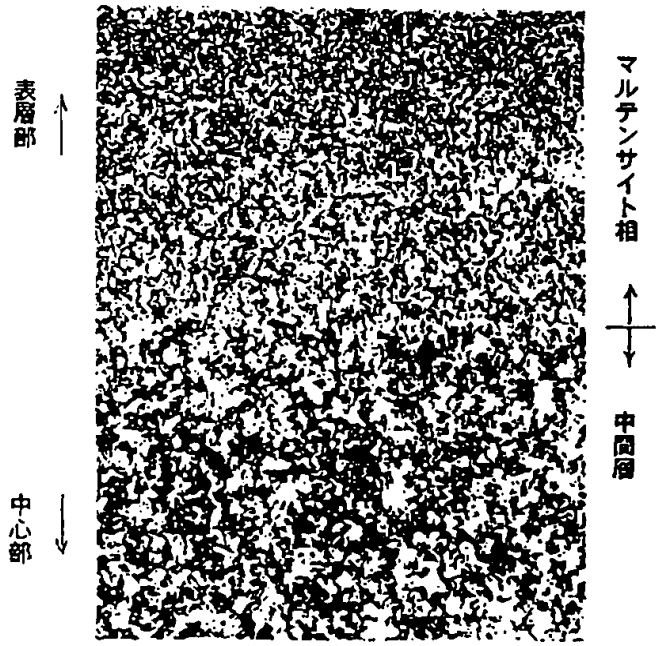
(b)

FIG. 13



球状化焼鈍前
表層部×１００

FIG. 14

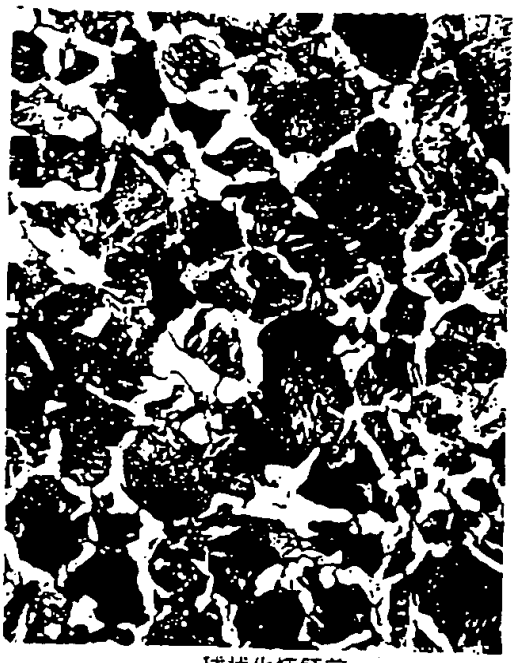


球状化焼鈍前
表層部と中間層×２００

FIG. 15

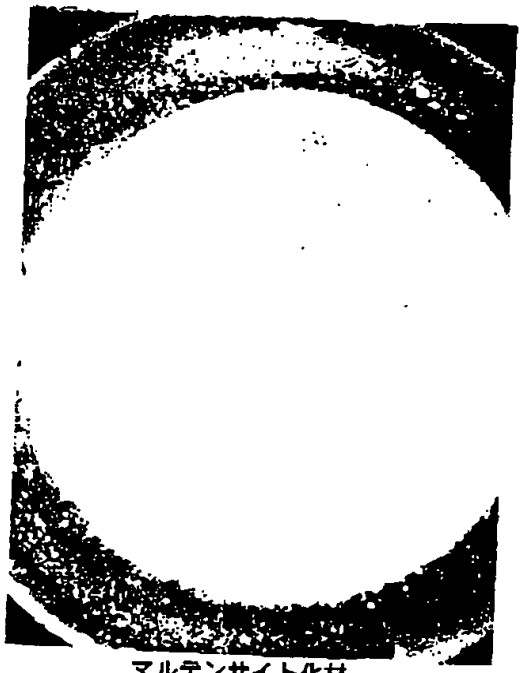
球状化焼鈍前
1／2R部×４００

FIG. 16



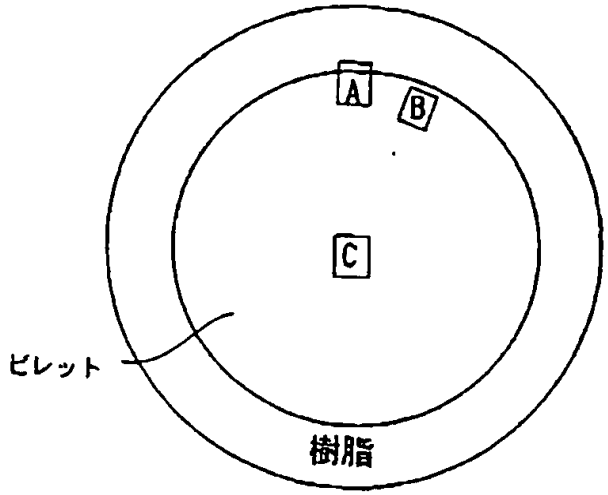
球状化焼鈍前
中心部×４００

FIG. 17



マルテンサイト化材
球状化焼鈍パターン1後
×2、1

(a)

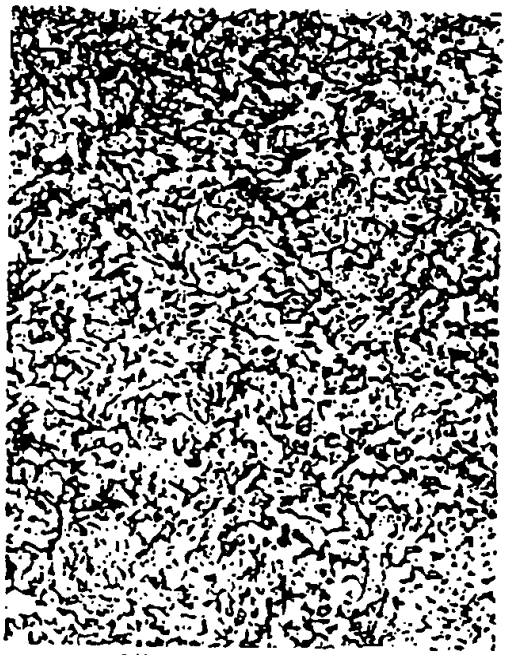


(b)

FIG. 18

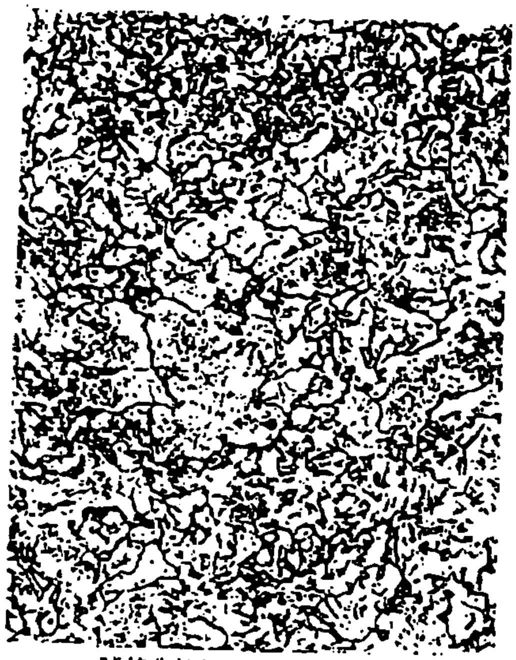
球状化焼鈍パターン１後
表層部ｘ１００

FIG. 19



球状化焼鈍パターン１後
表層部ｘ４００

FIG. 20

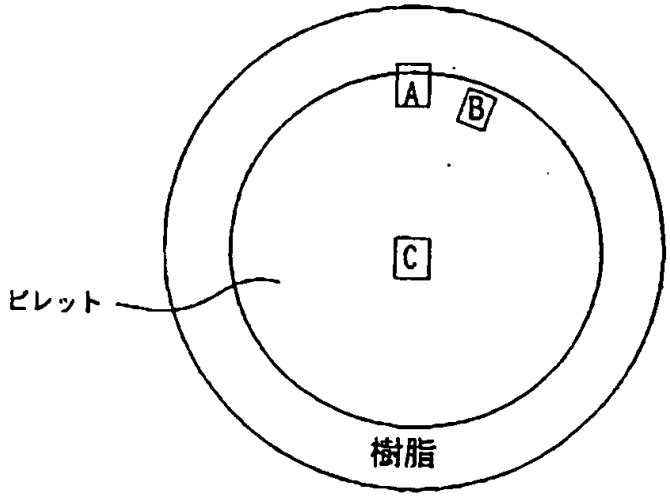


球状化焼鈍パターン1後
1／2R部x400

FIG. 21

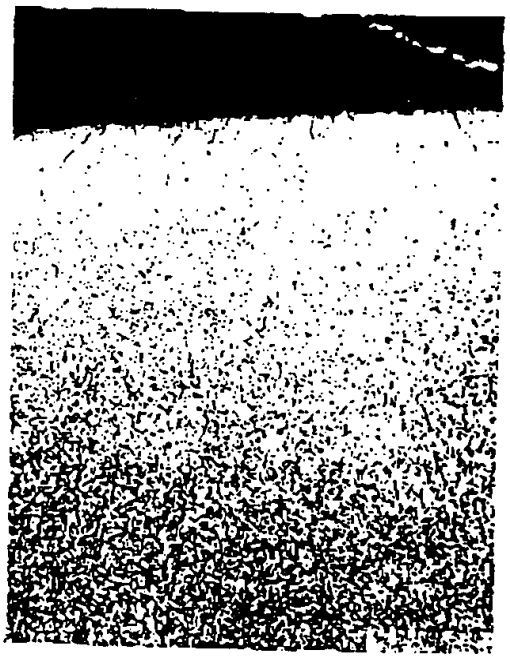
マルテンサイト化材
球状化焼鈍パターン２後
×２．１

(a)



(b)

FIG. 22



球状化焼鈍パターン２後
表層部ｘ１００

FIG. 23

球状化焼鈍パターン２後
表層部ｘ４００

FIG. 24

球状化焼鈍パターン２後
１／２Ｒ部ｘ４００

FIG. 25

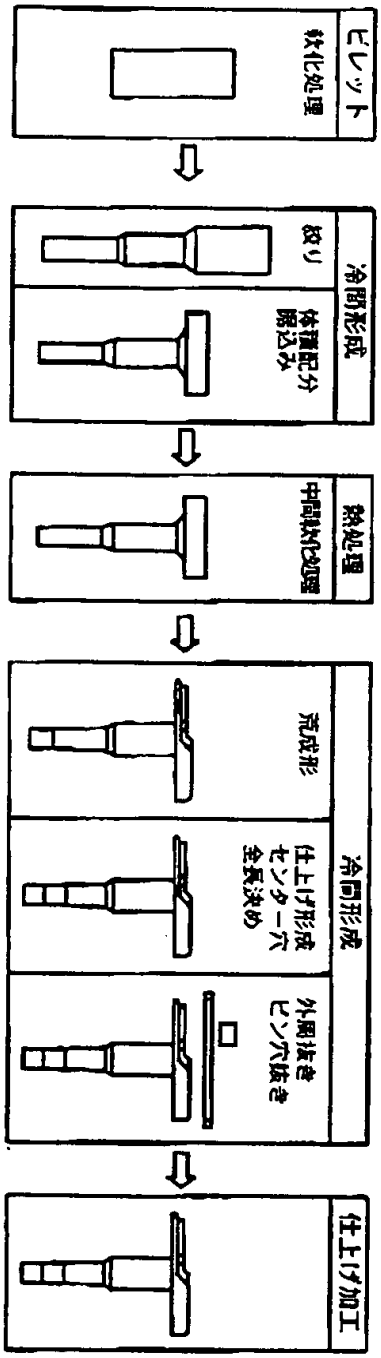

ビレット
軟化処理
冷間形成
絞り
体積配分
据込み
熱処理
中間軟化処理
冷間形成
荒成形
仕上げ形成
センター穴
全長決め
外周抜き
ピン穴抜き
仕上げ加工

FIG. 26

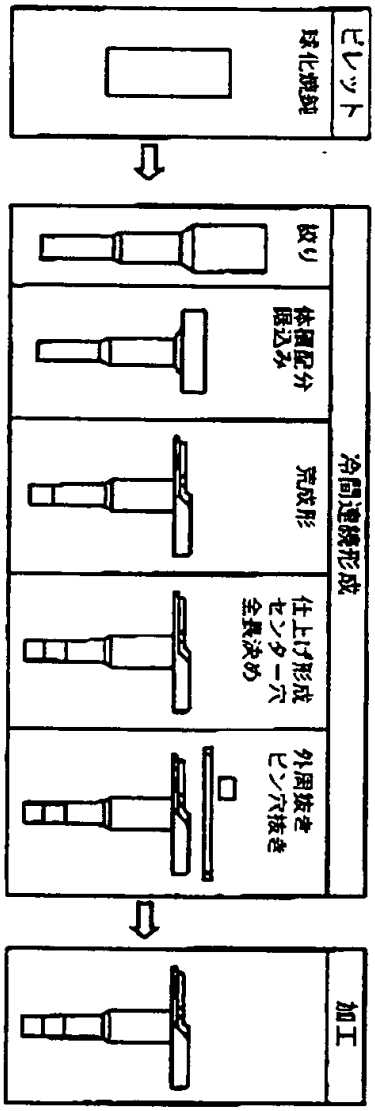

ビレット
球化焼鈍
冷間連続形成
絞り
体積配分
据込み
荒成形
仕上げ形成
センター穴
全長決め
外周抜き
ピン穴抜き
加工

FIG. 27

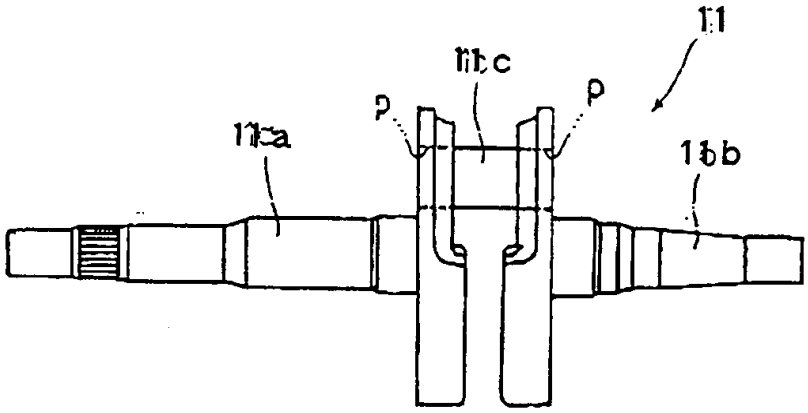


FIG. 28

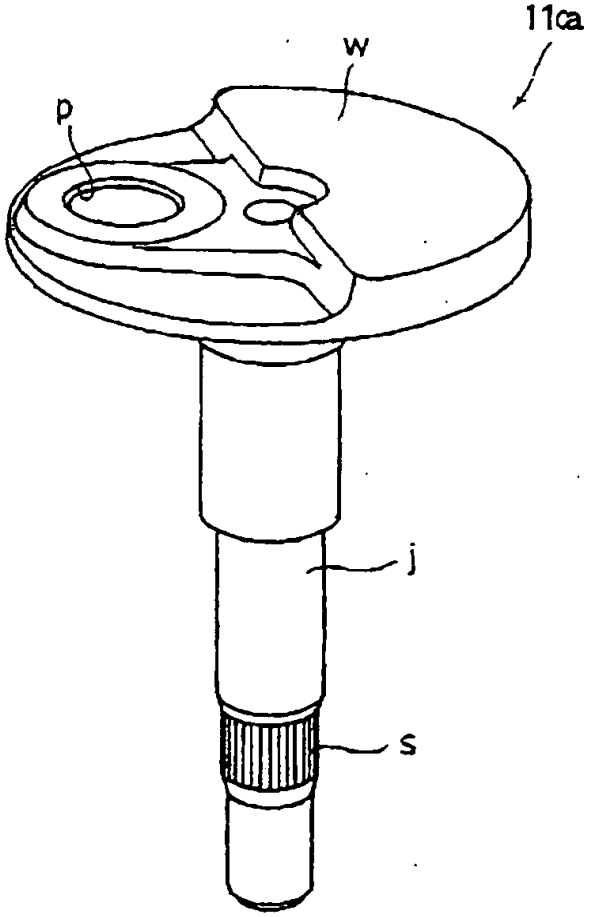
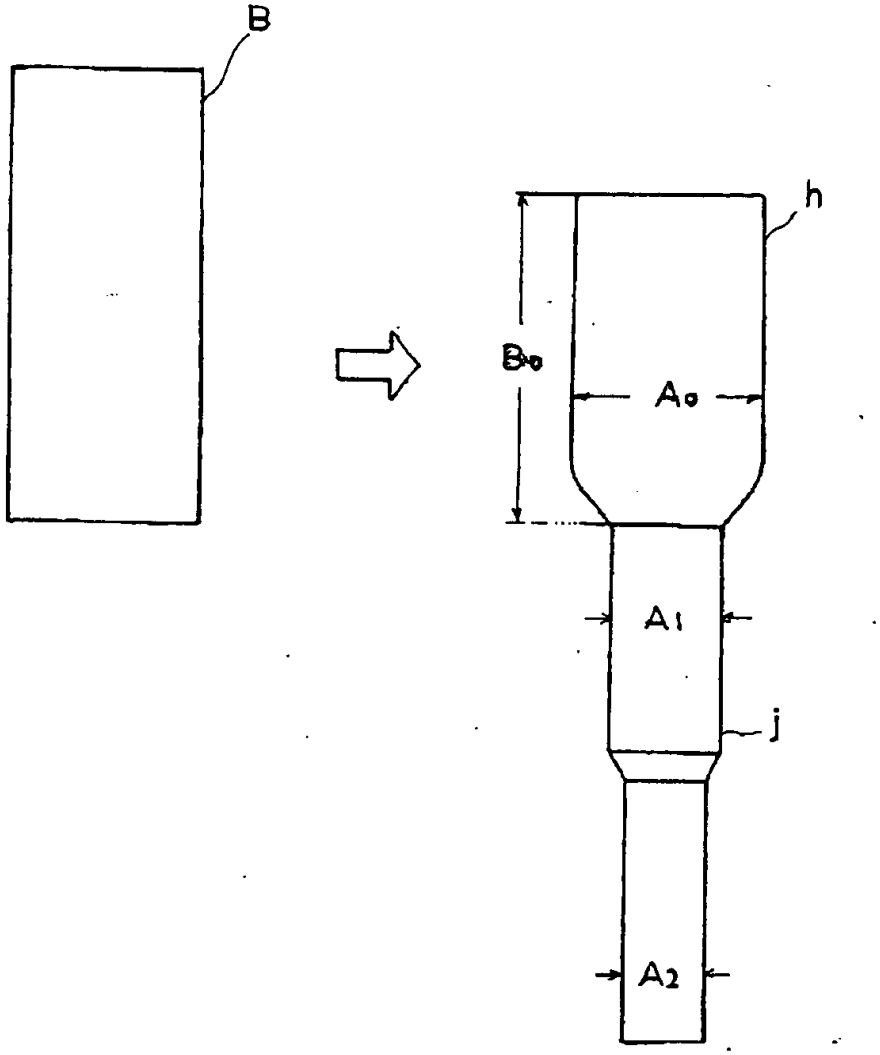


FIG. 29



(a)

(b)

FIG. 30

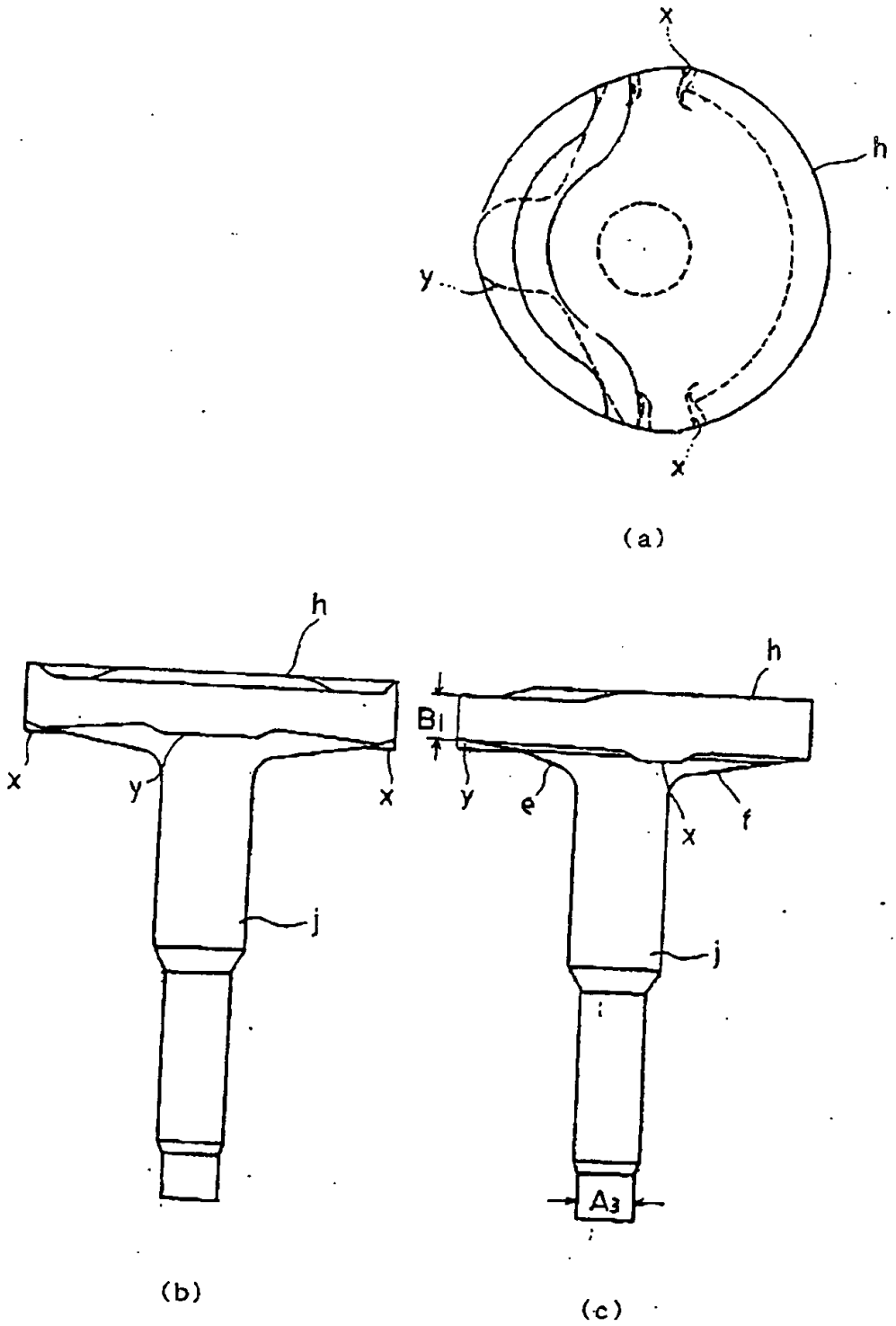
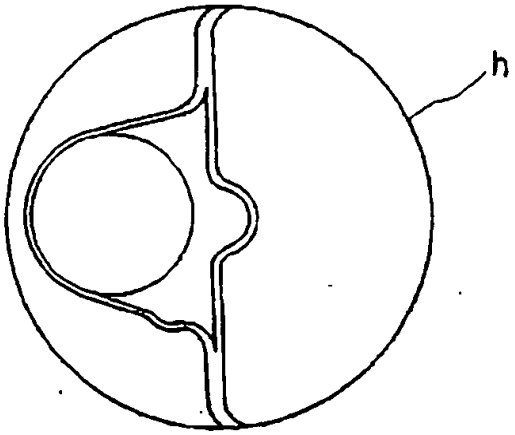
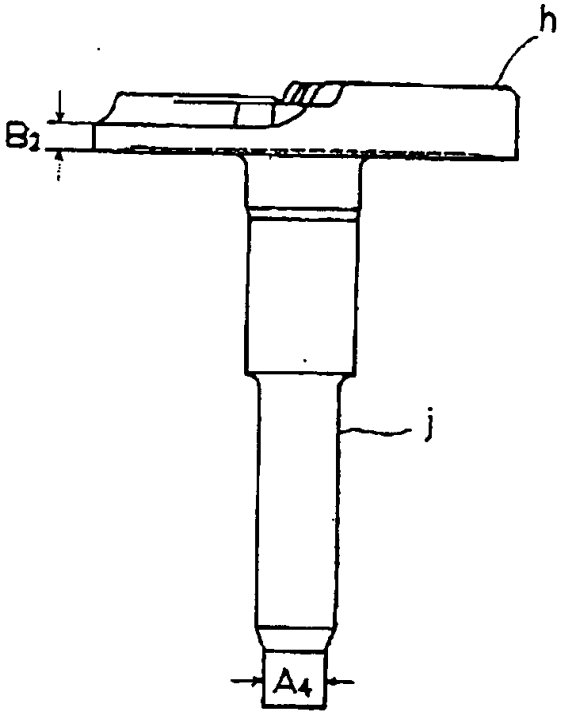


FIG. 31

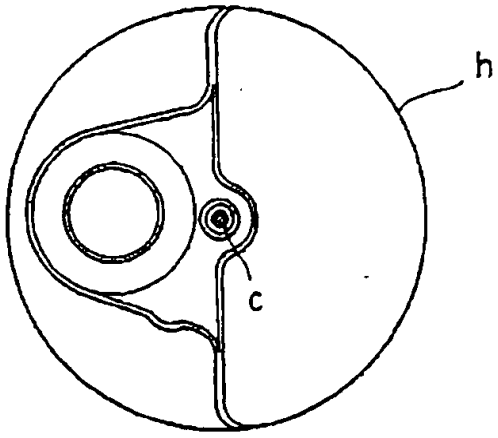


(a)

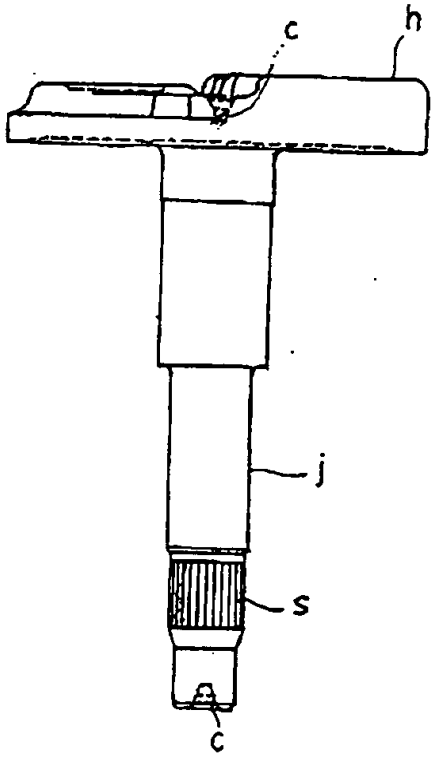


(b)

FIG. 32

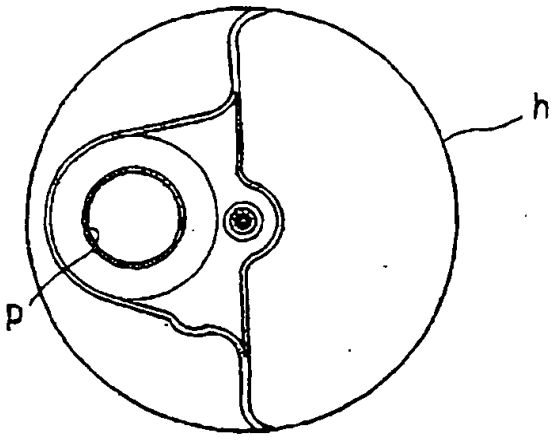


(a)

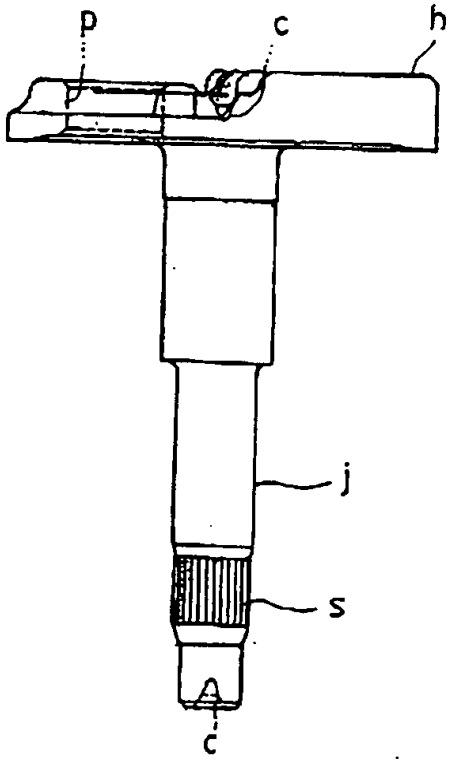


(b)

FIG. 33



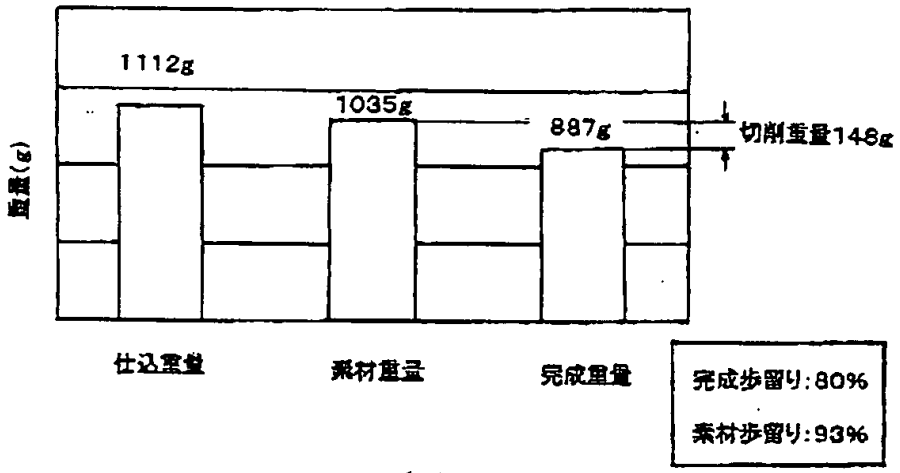
(a)



(b)

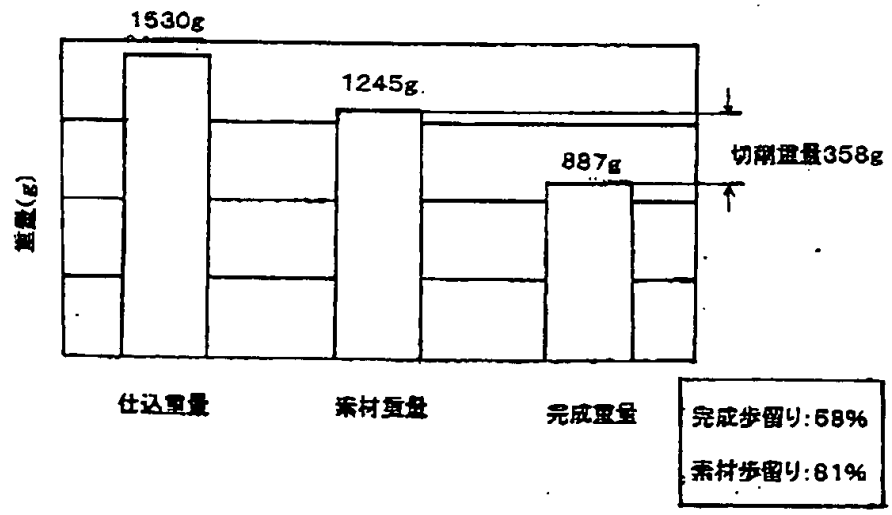
FIG. 34

（本発明の冷間鍛造方法）



(a)

（従来の冷間鍛造方法）



(b)

FIG. 35

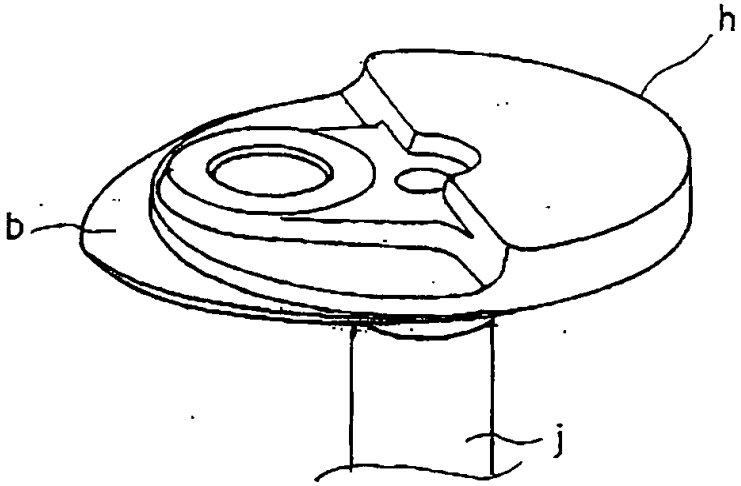
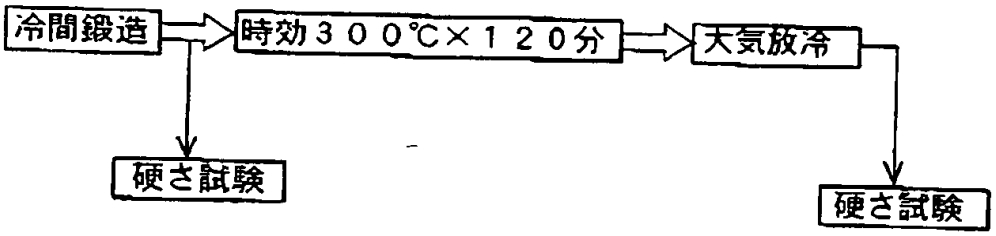
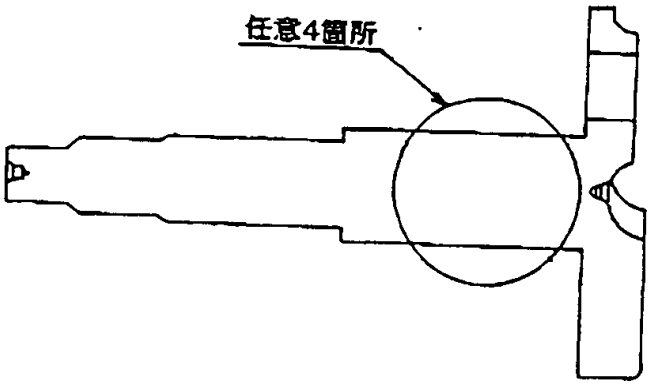


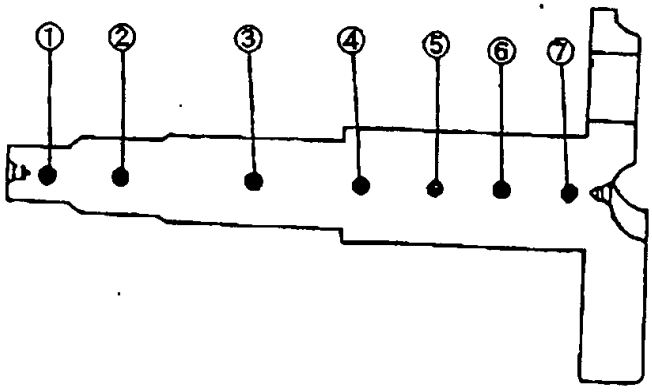
FIG. 36



(a)



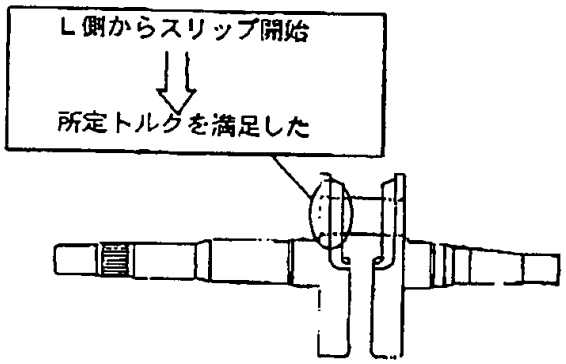
(b)



(c)

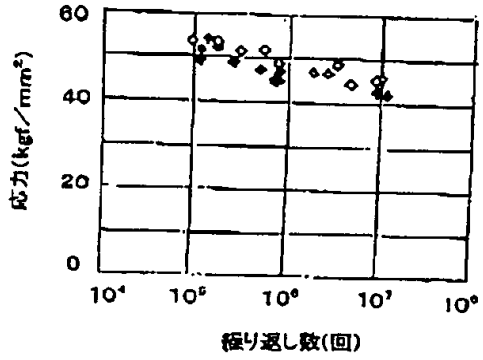
FIG. 37

スリップトルク



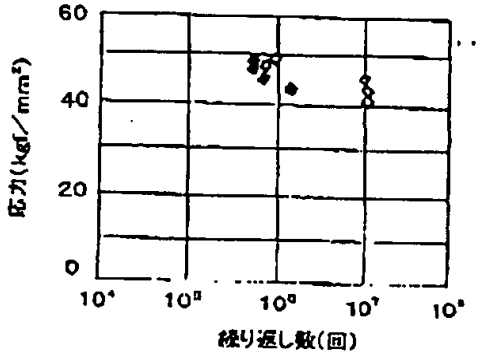
(a)

S－N曲線(回転曲げ疲労試験)



(b)

S－N曲線(実体曲げ疲労試験)



(c)

FIG. 38

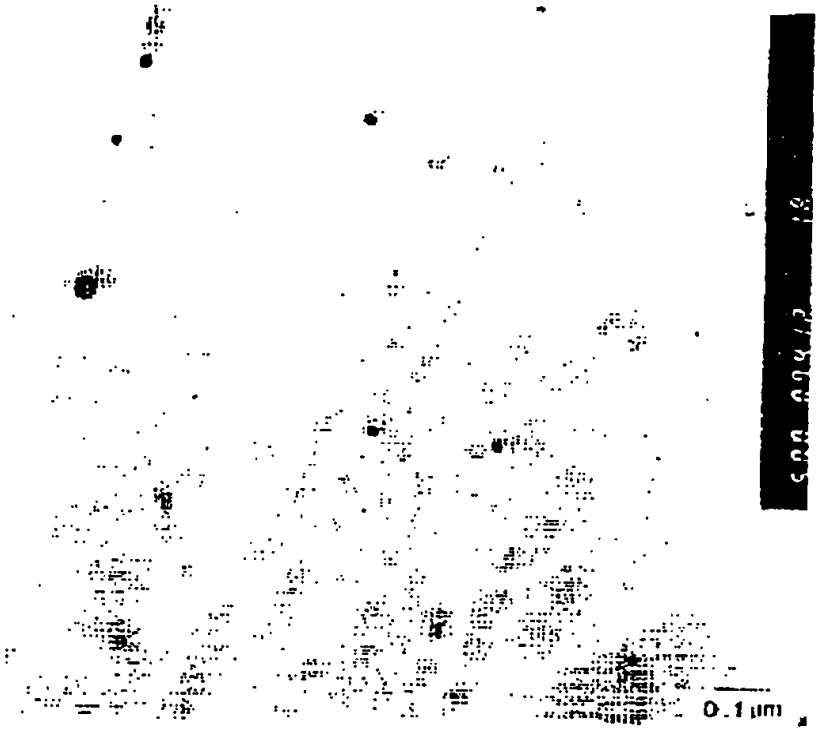


FIG. 39

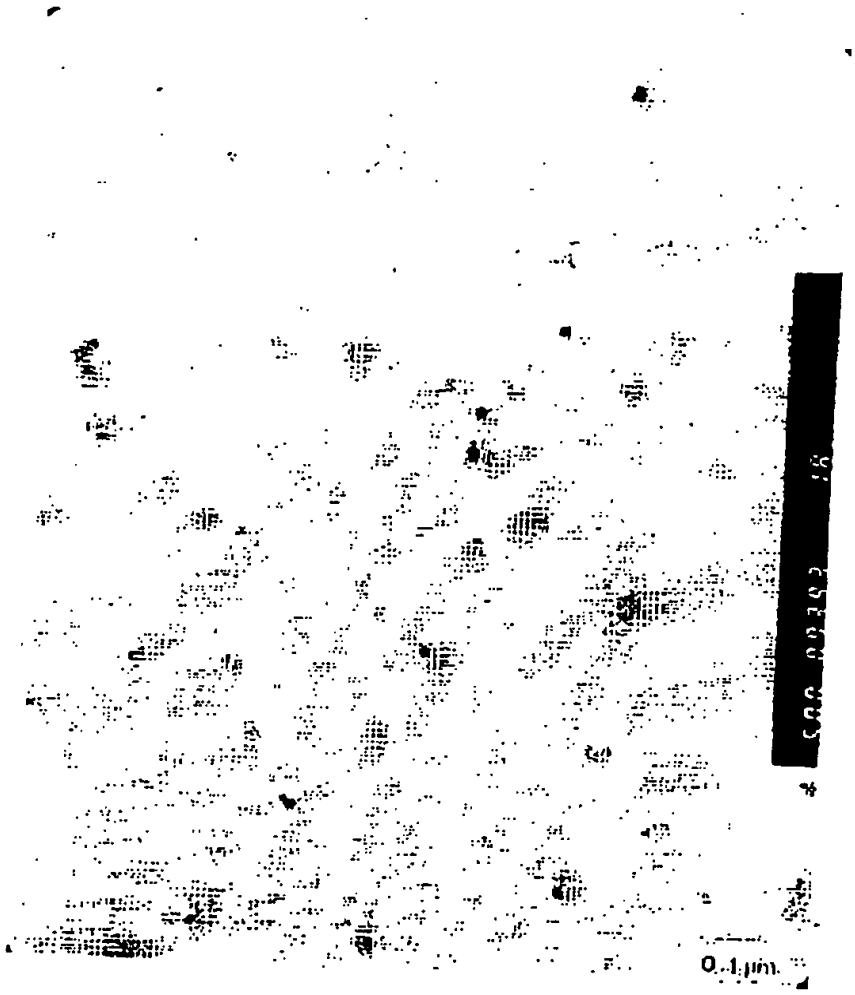


FIG. 40

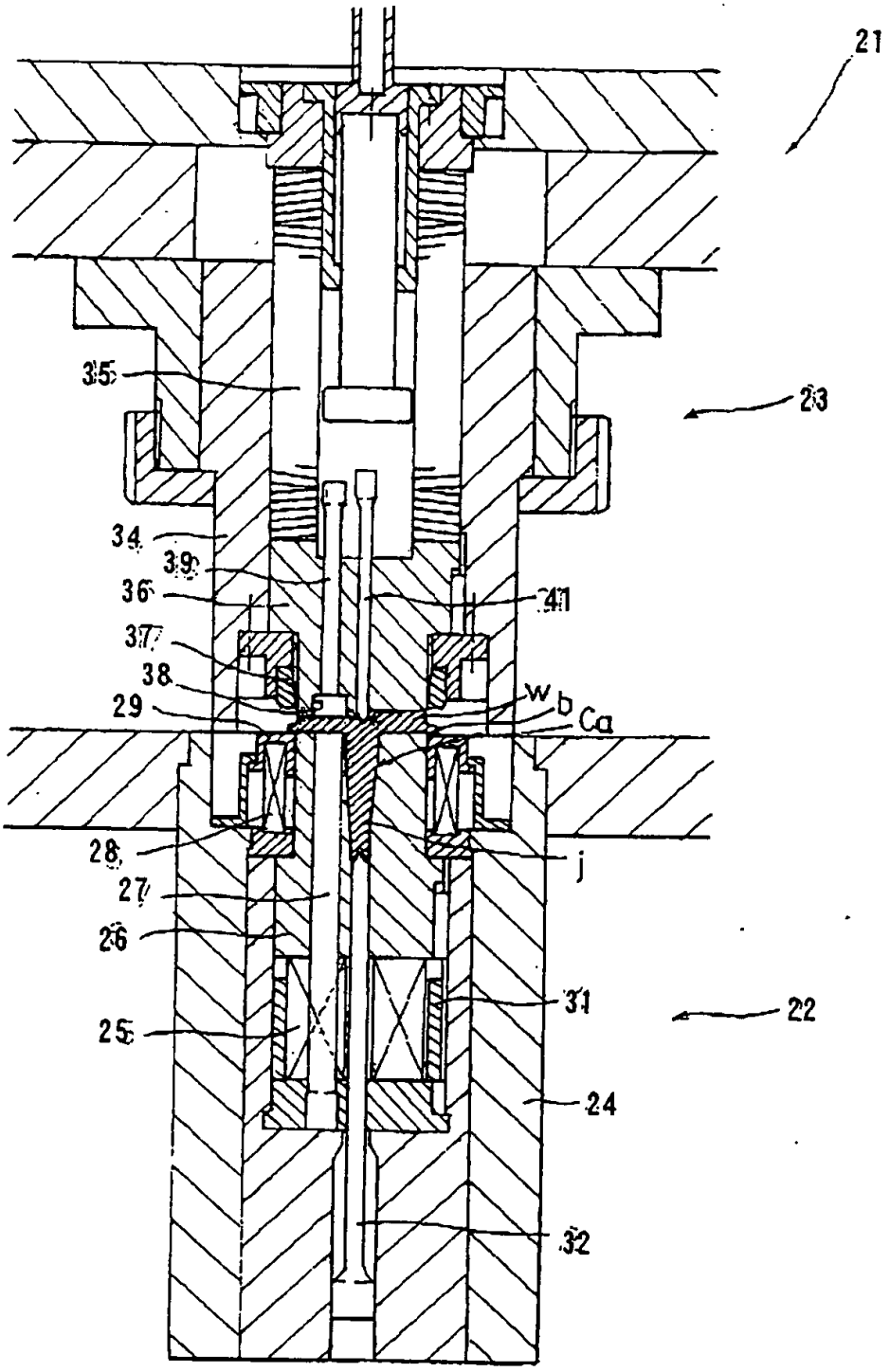


FIG. 41

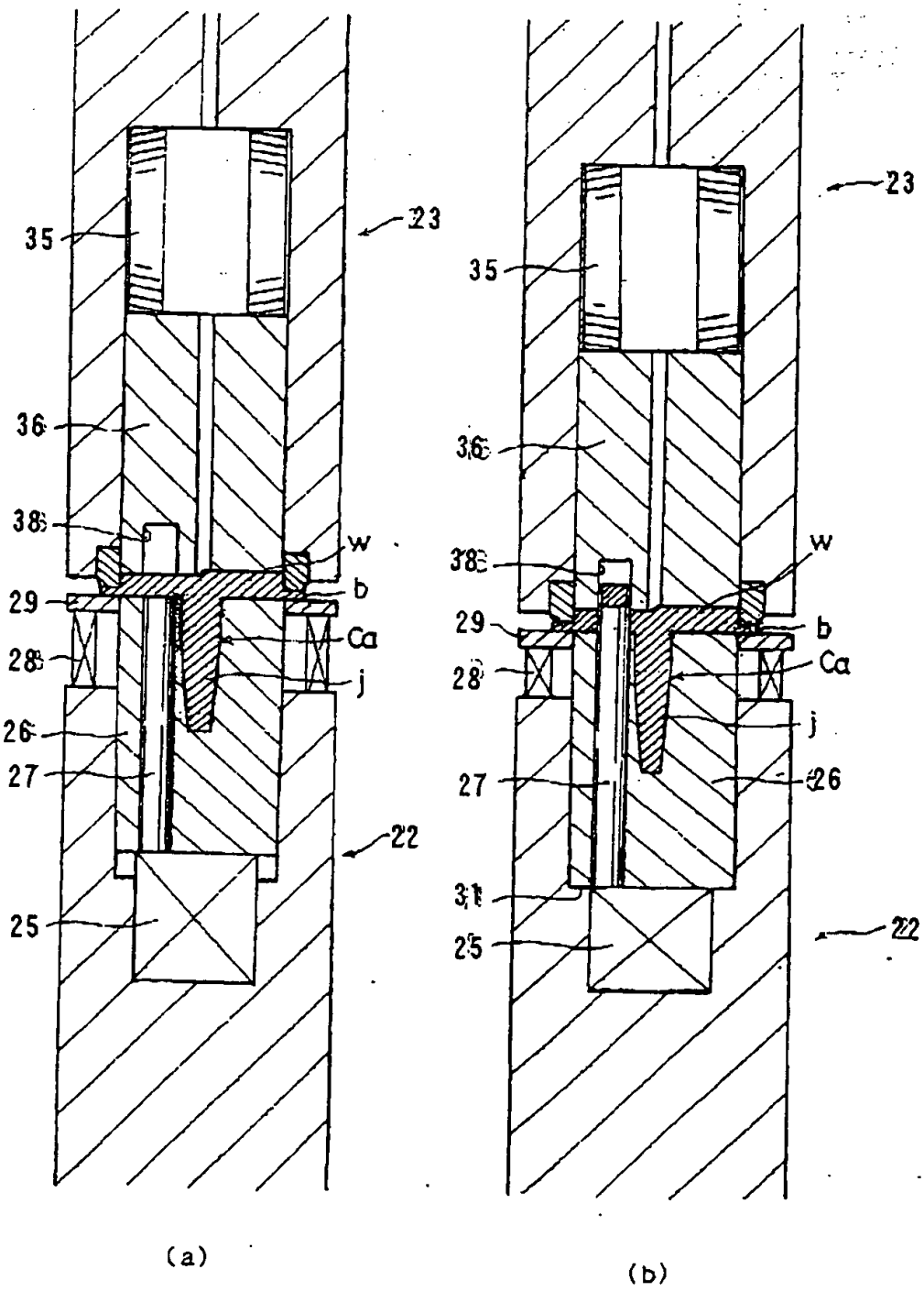

35
23
36
38
w
b
29
Ca
28
j
26
27
22
25
(a)
35
23
36
38
w
29
b
Ca
28
j
27
26
31
25
22
(b)

FIG. 42

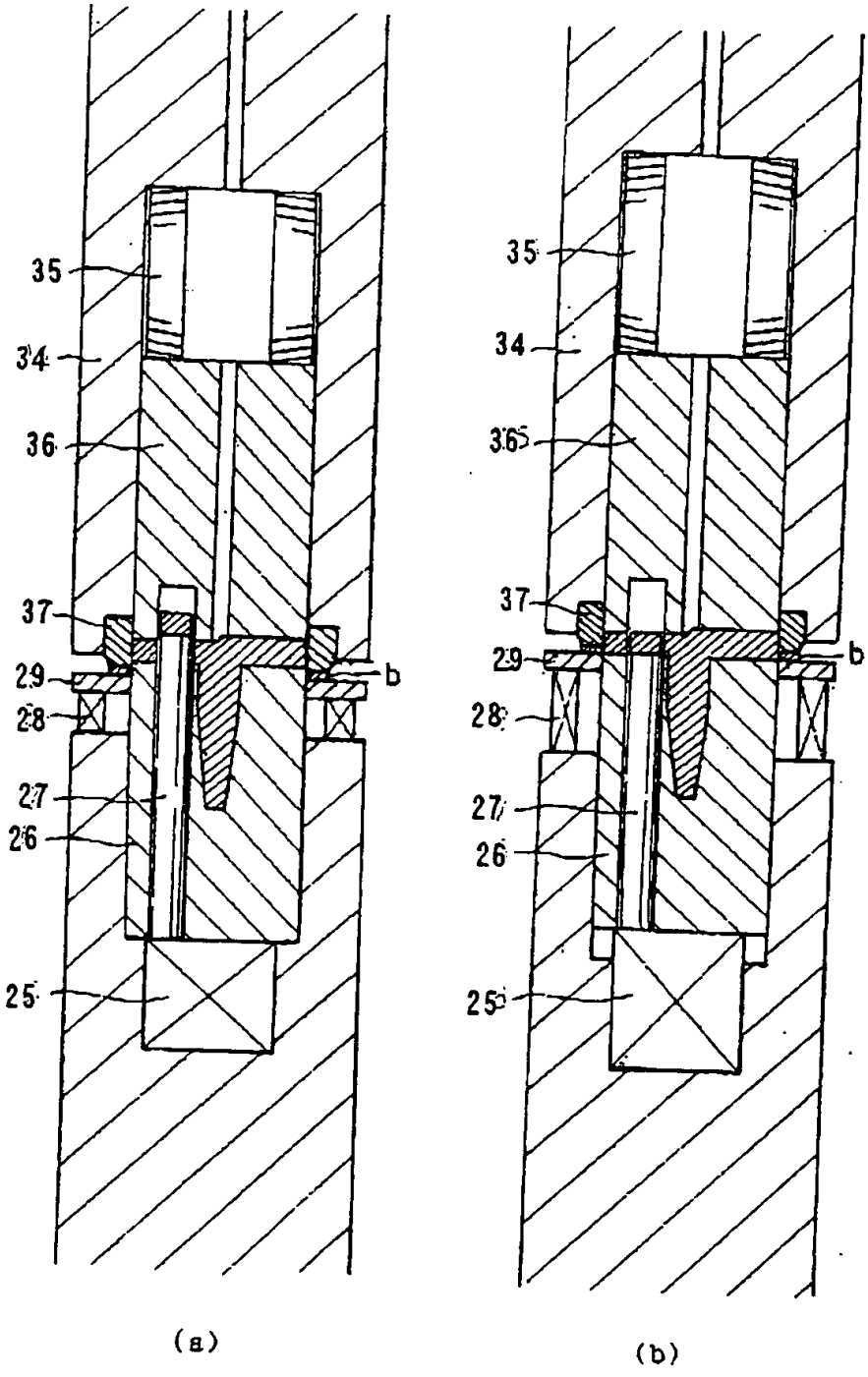


FIG. 43

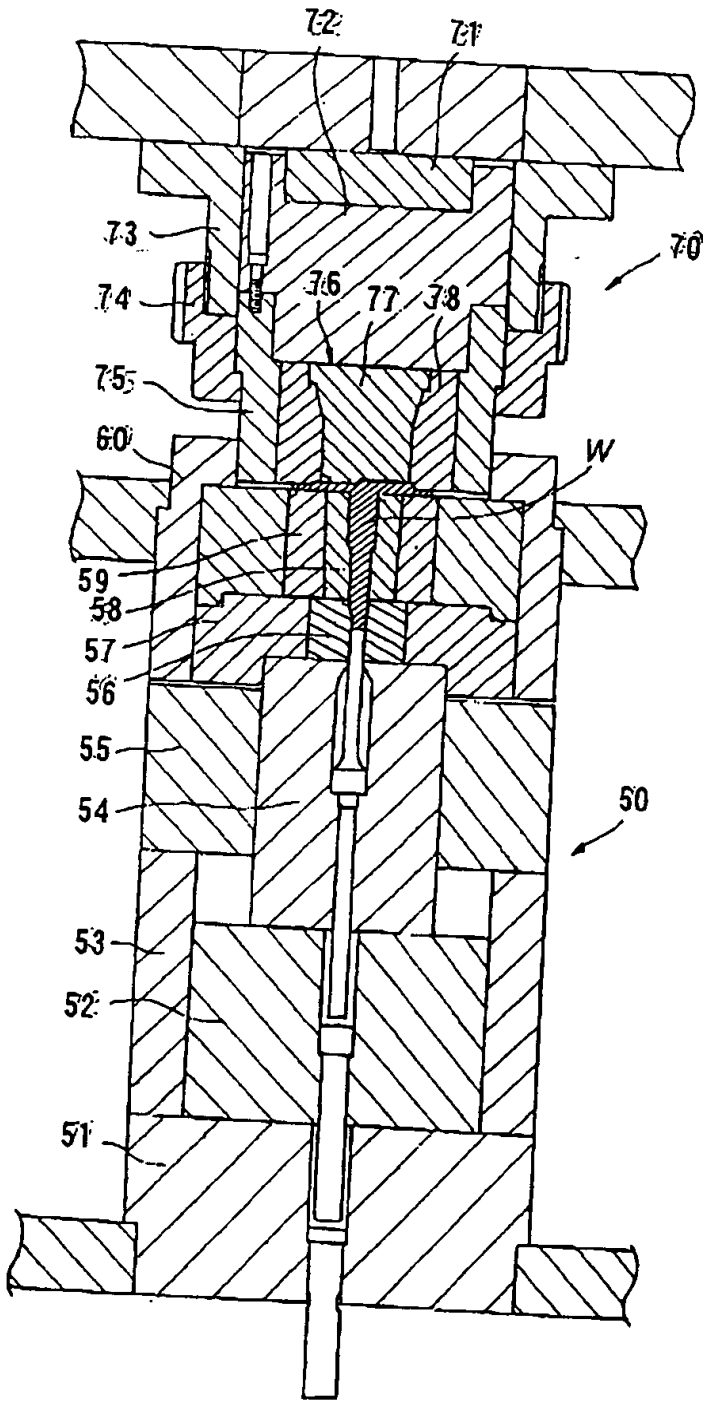


FIG. 44

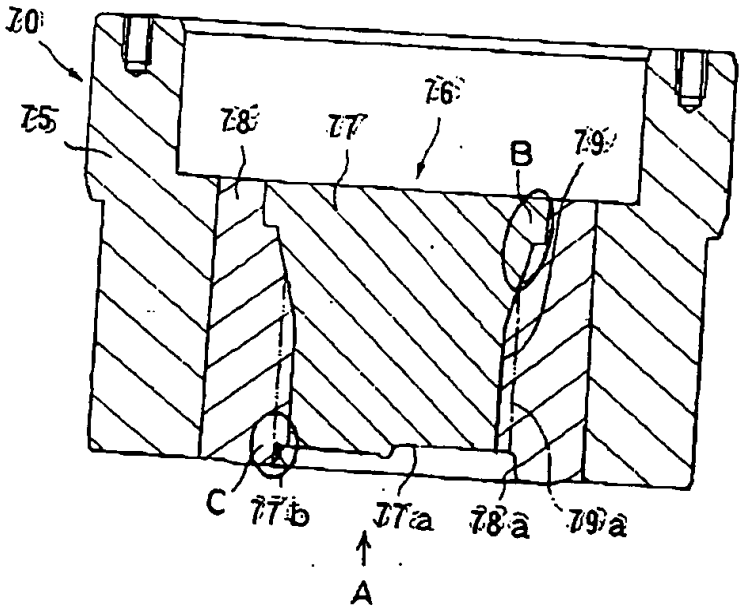


FIG. 45

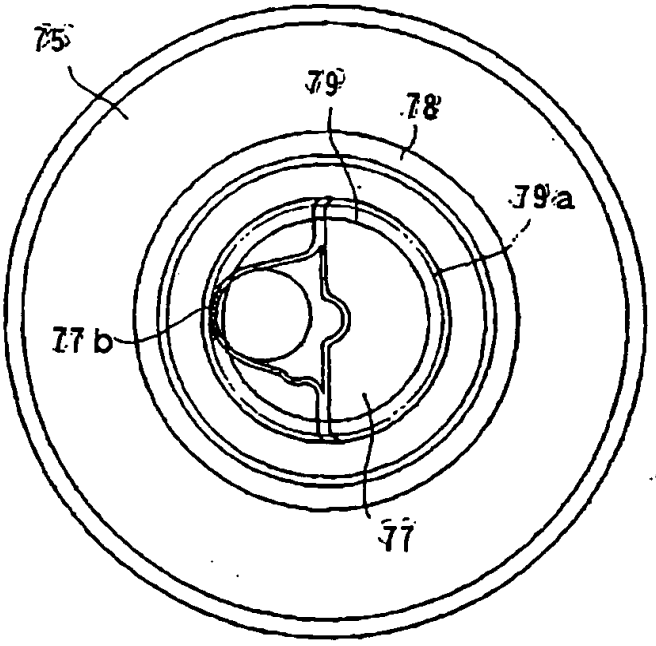


FIG. 46

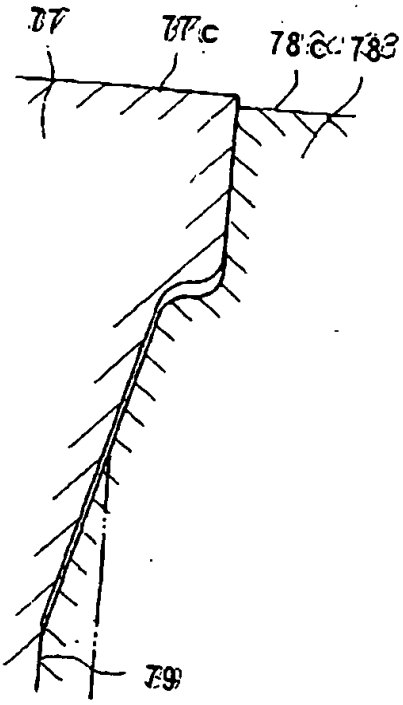


FIG. 47

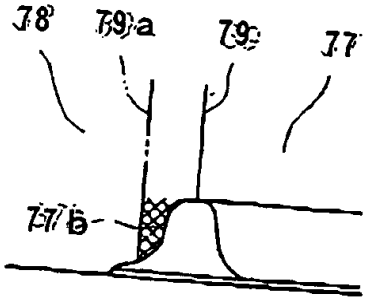


FIG. 48